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EXAMINER	
NOLAN, PETER D	

ART UNIT	PAPER NUMBER
3661	

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08/25/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.**	**Applicant(s)**	
	10/567,165	TERASHIMA ET AL.	
	Examiner	**Art Unit**	
	Peter D. Nolan	3661	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _08 June 2009_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-7_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-7_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _03 February 2006_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

The amendment to the claims filed 6/8/2009 has been entered. Claims 1-7 remain pending.

Claim Objections

1. Claims 1, 2 are objected to because of the following informalities:

2. In claim 1, line 4 and claim 2, line 4 the phrase "the control being made by operating a controller having a filter unit by using a feedforward control program" should be changed to "the control being made by operating a controller having a filter unit using a feedforward control program" or "the control being made by operating a controller having a filter unit containing a feedforward control program" or a similar correction.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-4, 7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

3. The term "changing their values little by little" in claims 1-4, 7 is a relative term which renders the claim indefinite. The term "little by little" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Habisohn (US 6102221) in view of Feddema et al. (US 5785191) and Bose (N. K. Bose, *Digital Filters Theory and Applications*. Malabar, Florida: Krieger Publishing Company, 1993.).

3. **Regarding claim 1**, Habisohn teaches a method for controlling a crane drive unit so as to suppress sway of a load suspended by a rope of a crane, which sway occurs when the load has been transported from a first position to a second position (**see Habisohn column 3, lines 29-32**), the control being made by operating a controller having a filter unit by using a feedforward control program (**see Habisohn figure 2, Motor Controller 26 containing Damping Filter 40 and column 3, lines 13-28**), comprising: removing a component near a resonance frequency by the filter unit from a transportation command for the load (**see Habisohn column 5, line 66 thru column 6, line 5 and column 10, lines 6-27**), in which command a maximum value among at least one of a transportation speed, transportation acceleration, and transportation jerk is limited (**see Habisohn column 21, lines 39-54**), under the resonance frequency sequentially computed from a rope length that is a distance from the center of rotation of the sway of the rope to the center of gravity of the load (**see Habisohn column 7, lines**

34-44; column 10, lines 6-27; column 13, lines 46-54) and under parameters that relate to a control unit of the crane drive unit and that are previously computed so as not to exceed a performance of the crane drive unit (**see Habisohn column 5, line 66 thru column 6, line 5; column 10, lines 6-27; column 21, lines 39-54**); and inputting the transportation command from which the component near the resonance frequency is removed into the crane drive unit, thereby controlling the crane drive unit so that the load does not greatly sway when the load is transported from the first position to the second position (**see Habisohn column 5, lines 37-49**).

4. However, Habisohn does not teach where, based on expression (1) or (2), the component near the resonance frequency is removed by using parameters $a_i(f)$ and $b_j(f)$, which are determined by computing them in a simulation in which a model expressing the characteristics of the crane is used, while changing their values little by little, and which values are stored,

Expression (1)

$$y(t) = b_0(f)x(t) + b_1(f)x(t-1) + b_2(f)x(t-2) + \cdots - a_1(f)y(t-1) - a_2(f)y(t-2) - \cdots$$

$$y(t) = \sum_{j=0}^{m} b_j(f)x(t-j) - \sum_{i=1}^{n} a_i(f)y(t-i)$$

where $a_i(f)$ and $b_j(f)$ are parameters mediated by the resonance frequency f sequentially computed for the varying length of the rope, and

Expression (2)

$$F(S)=\frac{Y(S)}{X(S)}=\frac{b_0(f)S^0+b_1(f)S^1+b_2(f)S^2+\cdots}{a_0(f)S^0+a_1(f)S^1+a_2(f)S^2+\cdots}=\frac{\sum_{j=0}^{m} b_j(f)S^j}{\sum_{i=0}^{n} a_i(f)S^i}$$

where expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2), and S is a Laplacian operator.

5. Feddema teaches a method for controlling a crane (**see Feddema Abstract**) where, based on expression (1), (**see Feddema column 16, equation 12 and lines 16-21**), a component near a resonant frequency is removed using parameters that are determined by computing them in a simulation in which a model expressing the characteristics of the crane is used (**see Feddema figure 4; column 9, lines 27-43; column 11, lines 8-27; equation 12 and column 16, lines 16-57**) while changing the values little by little, and which values are stored (**see Feddema column 11, lines 8-27**), where the parameters in expression (1) are mediated by the resonance frequency sequentially computed for the varying length of the rope (**see Feddema column 11, lines 8-27**) and where expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2) and S is a Laplacian operator (**expression 2 is the transfer function of an Nth-order, linear and time invariant filter which has the filter output characteristic of equation 12 in Feddema**).

6. It would be obvious to one skilled in the art to modify the method in Habisohn with the filtering steps in Feddema because an infinite impulse response (IIR) filtering

scheme, such as the one in Feddema, requires less hardware and can perform a filtering task with greater speed than other types of filters (**see Bose page 159**).

7. **Regarding claim 2**, Habisohn teaches a system for controlling a crane drive unit so as to suppress sway of a load suspended by a rope of a crane, which sway occurs when the load has been transported from a first position to a second position (**see Habisohn figure 2, motor controller 26 and column 5, lines 18-24**), the control being made by operating a controller having a filter unit by using a feedforward control program (**see Habisohn figure 2, Motor Controller 26 containing Damping Filter 40 and column 3, lines 13-28**), comprising: a rope length detection unit for detecting a rope length that is a distance from the center of rotation of the sway of the rope to the center of gravity of the load (**see Habisohn figure 1, Rope Length Sensor 45 and column 5, lines 50-52**); a resonance frequency computing unit for computing a resonance frequency of the rope having said rope length (**see Habisohn column 5, lines 44-46; column 7, lines 34-44; column 13, lines 46-54**); a transportation command transmitting unit for transmitting a transportation command for the load given by a transportation command applicator (**see Habisohn figure 1, Motion Selector 34 and column 5, lines 33-34**); a parameter computing unit for previously computing parameters for a control unit of the crane drive unit so that the parameters do not exceed a performance of the crane drive unit (**see Habisohn column 21, lines 39-54**); a parameter storing unit for receiving and storing the parameters from the parameter computing unit (**see Habisohn column 21, lines 39-54**); a maximum value limiting unit for limiting a maximum value among at least one of a transportation speed,

transportation acceleration, and transportation jerk in the transportation command for the load from the transportation command transmitting unit under the parameters from the parameter storing unit (**see Habisohn column 21, lines 39-54**); and a filter unit for receiving the resonance frequency from the resonance frequency calculating unit, the filter unit removing a component near the resonance frequency from the transportation command in which the maximum value is limited by the maximum value limiting unit (**see Habisohn column 5, lines 44-46; column 7, lines 34-44; column 13, lines 46-54; column 21, lines 39-54**), under the parameters from the parameter storing unit, the filter unit inputting in the crane drive unit the transportation command from which the component near the resonance frequency is removed (**see Habisohn column 5, lines 37-49**),

8. However, Habisohn does not teach where based on expression (1) or (2), the component near the resonance frequency is removed by using parameters $a_i(f)$ and $b_j(f)$, which are determined by computing them in a simulation in which a model expressing the characteristics of the crane is used, while changing their values little by little, and which values are stored,

Expression (1)

$$y(t) = b_0(f)x(t) + b_1(f)x(t-1) + b_2(f)x(t-2) + \cdots - a_1(f)y(t-1) - a_2(f)y(t-2) - \cdots$$

$$y(t) = \sum_{j=0}^{m} b_j(f)x(t-j) - \sum_{i=1}^{n} a_i(f)y(t-i)$$

where $a_i(f)$ and $b_j(f)$ are parameters mediated by the resonance frequency f sequentially computed for the varying length of the rope, and

Expression (2)

$$F(S)=\frac{Y(S)}{X(S)}=\frac{b_0(f)S^0+b_1(f)S^1+b_2(f)S^2+\cdots}{a_0(f)S^0+a_1(f)S^1+a_2(f)S^2+\cdots}=\frac{\sum_{j=0}^{m}b_j(f)S^j}{\sum_{i=0}^{n}a_i(f)S^i}$$

where expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2), and S is a Laplacian operator.

9. Feddema teaches a system for controlling a crane (**see Feddema Abstract; figure 1; column 8, lines 19-46**) where, based on expression (1), (**see Feddema column 16, equation 12 and lines 16-21**), a component near a resonant frequency is removed using parameters that are determined by computing them in a simulation in which a model expressing the characteristics of the crane is used (**see Feddema figures 1A and 4; column 9, lines 27-43; column 11, lines 8-27; equation 12 and column 16, lines 16-57**) while changing the values little by little, and which values are stored (**see Feddema column 11, lines 8-27**), where the parameters in expression (1) are mediated by the resonance frequency sequentially computed for the varying length of the rope (**see Feddema column 11, lines 8-27**) and where expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2) and S is a Laplacian operator (**expression 2 is the transfer function of an Nth-order, linear and time invariant filter which has the filter output characteristic of equation 12 in Feddema**).

10. It would be obvious to one skilled in the art to modify the method in Habisohn with the filtering steps in Feddema because an infinite impulse response (IIR) filtering

scheme, such as the one in Feddema, requires less hardware and can perform a filtering task with greater speed than other types of filters (**see Bose page 159**).

11. **Regarding claim 3**, Habisohn teaches a medium in which a feedforward control program is stored (**see Habisohn column 5, lines 53-58**), the feedforward control program controlling a crane drive unit by a controller having a filter unit so as to suppress sway of a load suspended by a rope of a crane, which sway occurs when the load has been transported from a first position to a second position (**see Habisohn column 3, lines 29-32. See also Habisohn figure 2, motor controller 26 containing filter unit 40 and column 5, lines 18-24**), the feedforward control program being programmed to cause the filter unit of the controller to remove a component near a resonance frequency from a transportation command for the load (**see Habisohn column 5, lines 44-46; column 7, lines 34-44; column 13, lines 46-54**), in which command a maximum value among at least one of a transportation speed, transportation acceleration, and transportation jerk is limited (**see Habisohn column 21, lines 39-54**), under the resonance frequency sequentially computed from a rope length that is a distance from the center of rotation of the sway of the rope to the center of gravity of the load (**see Habisohn column 7, lines 34-44; column 10, lines 6-27; column 13, lines 46-54**) and under parameters for a control unit of the crane drive unit, which parameters are previously computed so as not to exceed a performance of the crane drive unit (**see Habisohn column 5, line 66 thru column 6, line 5; column 10, lines 6-27; column 21, lines 39-54**), the feedforward control program being also programmed to cause the filter unit to input the transportation command from which the

component near the resonance frequency is removed in the crane drive unit (**see Habisohn column 5, lines 37-49**).

12. However, Habisohn does not teach where based on expression (1) or (2), the component near the resonance frequency is removed by using parameters $a_i(f)$ and $b_j(f)$, which are determined by computing them in a simulation in which a model expressing the characteristics of the crane is used, while changing their values little by little, and which values are stored,

Expression (1)

$$y(t) = b_0(f)x(t) + b_1(f)x(t-1) + b_2(f)x(t-2) + \cdots - a_1(f)y(t-1) - a_2(f)y(t-2) - \cdots$$

$$y(t) = \sum_{j=0}^{m} b_j(f)x(t-j) - \sum_{i=1}^{n} a_i(f)y(t-i)$$

where $a_i(f)$ and $b_j(f)$ are parameters mediated by the resonance frequency f sequentially computed for the varying length of the rope, and

Expression (2)

$$F(S) = \frac{Y(S)}{X(S)} = \frac{b_0(f)S^0 + b_1(f)S^1 + b_2(f)S^2 + \cdots}{a_0(f)S^0 + a_1(f)S^1 + a_2(f)S^2 + \cdots} = \frac{\sum_{j=0}^{m} b_j(f)S^j}{\sum_{i=0}^{n} a_i(f)S^i}$$

where expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2), and S is a Laplacian operator.

13. Feddema teaches a medium in which a feed forward control program for controlling a crane is stored (**see Feddema Abstract. See also figure 1 and column 8, lines 19-46 where the filter may be implemented in a digital signal processor**

and column 10, lines 61-64) where, based on expression (1), (**see Feddema column 16, equation 12 and lines 16-21**), a component near a resonant frequency is removed using parameters that are determined by computing them in a simulation in which a model expressing the characteristics of the crane is used (**see Feddema figure 4; column 9, lines 27-43; column 11, lines 8-27; equation 12 and column 16, lines 16-57**) while changing the values little by little, and which values are stored (**see Feddema column 11, lines 8-27**), where the parameters in expression (1) are mediated by the resonance frequency sequentially computed for the varying length of the rope (**see Feddema column 11, lines 8-27**) and where expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2) and S is a Laplacian operator (**expression 2 is the transfer function of an Nth-order, linear and time invariant filter which has the filter output characteristic of equation 12 in Feddema**).

14. It would be obvious to one skilled in the art to modify the method in Habisohn with the filtering steps in Feddema because an infinite impulse response (IIR) filtering scheme, such as the one in Feddema, requires less hardware and can perform a filtering task with greater speed than other types of filters (**see Bose page 159**).

15. Claims 4-7 are rejected under 35 USC 103(a) as being unpatentable over Robinett et al. (US 6442439 B1) in view of (N. K. Bose, *Digital Filters Theory and Applications*. Malabar, Florida: Krieger Publishing Company, 1993.).

16. **Regarding claim 4**, Robinett teaches a crane having a turning motor for turning a crane boom, a turning motor control unit for controlling a speed and a direction of

rotation of the turning motor, a rolling-up motor for rolling a rope of the crane up and down, and a rolling-up motor control unit for controlling a speed and a direction of rotation of the rolling-up motor (**see Robinett figures 1 and 2 and column 4, lines 15-22 and lines 57-67 where an operator of a crane controls: (1) slew velocity, (2) luff angle velocity, and (3) hoist velocity. See also column 5, lines 11-17 where the filtered operator commands are output to the respective servo controllers for slew, luff and hoist**), further comprising: a rope length detection unit for detecting a present length of a rope of the crane (**Robinett does not explicitly disclose a rope length detection unit for detecting a present length of the rope. However, it is inherent that the system in Robinett contains a rope length detection unit because the filters for slew velocity and luff velocity are dependent upon the hoist line length (see Robinett column 6, line 66 thru column 7, line 13 and claims 6, 7)**); and a controller electrically coupled to both the turning motor control unit and the rolling-up motor control unit (**see Robinett column 7, lines 14-17**), the controller outputting to the turning motor control unit a signal transformed from a signal of the rope length by a feedforward control to drive the turning motor based on the transformed signal from which the component near the resonance frequency is removed so as to suppress sway of a load suspended from the rope at a moment when the load has been transported from a first position to a second position (**see Robinett column 4, lines 23-55 and column 6, lines 52-65. See also column 7, lines 14-17 and figure 2; column 6, line 66 thru column 7, line 13 and claims 1, 6, 7. Although Robinett shows feedback in figure 2, it should be understood that the filter 22 in Robinett uses**

feedforward control and does not depend on the feedback, as shown in the above citations).

17. However, while Robinett teaches where a component near the resonant frequency is removed by computing parameters in a simulation in which a model expressing the characteristics of the crane is used (**see Robinett column 5, line 20 thru column 6, line 17**), it does not teach where based on expression (1) or (2), the component near the resonance frequency is removed by using parameters $a_i(f)$ and $b_j(f)$, which are determined by computing them in a simulation in which a model expressing the characteristics of the crane is used, while changing their values little by little, and which values are stored,

Expression (1)

$$y(t) = b_0(f)x(t) + b_1(f)x(t-1) + b_2(f)x(t-2) + \cdots - a_1(f)y(t-1) - a_2(f)y(t-2) - \cdots$$

$$y(t) = \sum_{j=0}^{m} b_j(f)x(t-j) - \sum_{i=1}^{n} a_i(f)y(t-i)$$

where $a_i(f)$ and $b_j(f)$ are parameters mediated by the resonance frequency f sequentially computed for the varying length of the rope, and

Expression (2)

$$F(S) = \frac{Y(S)}{X(S)} = \frac{b_0(f)S^0 + b_1(f)S^1 + b_2(f)S^2 + \cdots}{a_0(f)S^0 + a_1(f)S^1 + a_2(f)S^2 + \cdots} = \frac{\sum_{j=0}^{m} b_j(f)S^j}{\sum_{i=0}^{n} a_i(f)S^i}$$

where expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2), and S is a Laplacian operator.

18. Bose teaches where an infinite impulse response (IIR) filter may have an output as shown in expression (1) of the current application (**see Bose page 159**). It is well known that expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2) where S is a Laplacian operator (**expression 2 is the transfer function of an Nth-order, linear and time invariant filter which has the filter output characteristic of the infinite impulse response filter in Bose**).

19. It would be obvious to one skilled in the art to use an IIR filter, as taught in Bose, in the system in Robinett because an IIR filter requires less hardware and can perform a filtering task with greater speed than other types of filters (**see Bose page 159**).

20. **Regarding claim 5**, Robinett, as modified by Bose in claim 4, teaches where the crane, further comprises a boom-hoisting motor for hoisting the crane boom and a boom-hoisting motor control unit for controlling a speed and a direction of rotation of the boom-hoisting motor, wherein the boom-hoisting motor control unit is electrically coupled to the controller (**see the rejection of claim 4 above regarding the control of the luff velocity**), and the controller further outputs to the boom-hoisting motor control unit the signal transformed from the signal of the rope length by the feedforward control so as to suppress the sway of the load suspended from the rope at the moment when the load has been transported from the first position to the second position (**see the rejection of claim 4 above regarding operation of the filters in the system in Robinett, which contains a filter for luff velocity**).

21. **Regarding claim 6**, Robinett, as modified by Bose in claim 4, teaches where the controller is attachable to an existing crane (**see Robinett column 3, lines 13-24**).

22. **Regarding claim 7**, Robinett teaches a controller for a crane attachable to an existing crane (**see Robinett column 3, lines 13-24**) that includes a turning motor for turning a boom of the crane, a boom-hoisting motor for hoisting the boom, a turning motor control unit for controlling a speed and a direction of rotation of the turning motor, and a boom-hoisting motor control unit for controlling a speed and a direction of rotation of the boom-hoisting motor (**see Robinett figures 1 and 2 and column 4, lines 15-22 and lines 57-67 where an operator of a crane controls: (1) slew velocity, (2) luff angle velocity, and (3) hoist velocity. See also column 5, lines 11-17 where the filtered operator commands are output to the respective servo controllers for slew, luff and hoist**), wherein only a signal of a rope length of the crane is inputable to the controller, and wherein the controller outputs a signal transformed from the signal of the rope length by a feedforward control to drive the turning motor and the boom-hoisting motor based on the transformed signal from which the component near the resonance frequency is removed, so as to suppress sway of a load suspended from a rope of the crane at a moment when the load has been transported from a first position to a second position under a condition that there is no disturbance (**see Robinett column 4, lines 23-55 and column 6, lines 52-65. See also column 7, lines 14-17 and figure 2; column 6, line 66 thru column 7, line 13 and claims 1, 6, 7 where the filtering is dependent on the rope length L2. Although Robinett shows feedback**

in figure 2, it should be understood that the filtering in Robinett uses feedforward control and does not depend on the feedback, as shown in the above citations),

23. However, while Robinett teaches where a component near the resonant frequency is removed by computing parameters in a simulation in which a model expressing the characteristics of the crane is used (**see Robinett column 5, line 20 thru column 6, line 17**), it does not teach where, based on expression (1) or (2), the component near the resonance frequency is removed by using parameters $a_i(f)$ and $b_j(f)$, which are determined by computing them in a simulation in which a model expressing the characteristics of the crane is used, while changing their values little by little, and which values are stored,

Expression (1)

$$y(t) = b_0(f)x(t) + b_1(f)x(t-1) + b_2(f)x(t-2) + \cdots - a_1(f)y(t-1) - a_2(f)y(t-2) - \cdots$$

$$y(t) = \sum_{j=0}^{m} b_j(f)x(t-j) - \sum_{i=1}^{n} a_i(f)y(t-i)$$

where $a_i(f)$ and $b_j(f)$ are parameters mediated by the resonance frequency f sequentially computed for the varying length of the rope, and

Expression (2)

$$F(S) = \frac{Y(S)}{X(S)} = \frac{b_0(f)S^0 + b_1(f)S^1 + b_2(f)S^2 + \cdots}{a_0(f)S^0 + a_1(f)S^1 + a_2(f)S^2 + \cdots} = \frac{\sum_{j=0}^{m} b_j(f)S^j}{\sum_{i=0}^{n} a_i(f)S^i}$$

where expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2), and S is a Laplacian operator.

24. Bose teaches where an infinite impulse response (IIR) filter may have an output as shown in expression (1) of the current application (**see Bose page 159**). It is well known that expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2) where S is a Laplacian operator (**expression 2 is the transfer function of an Nth-order, linear and time invariant filter which has the filter output characteristic of the infinite impulse response filter in Bose**).

25. It would be obvious to one skilled in the art to use an IIR filter, as taught in Bose, in the system in Robinett because an IIR filter requires less hardware and can perform a filtering task with greater speed than other types of filters (**see Bose page 159**).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this or any earlier communication from the examiner should be directed to Examiner Peter Nolan, whose telephone number is 571-270-7016. The examiner can normally be reached Monday-Friday from 7:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas Black, can be reached at 571-272-6956. The fax number for the organization to which this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Peter D Nolan/

Examiner, Art Unit 3661

8/20/2009

/Thomas G. Black/
Supervisory Patent Examiner, Art Unit 3661